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Factsheet

Factors which Affect the Inclusion Rate of Pig Feed Ingredients

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This Factsheet is intended as a guide for on-farm feed mixers who want to make economical use of different feed ingredients. It should be used in conjunction with OMAF Factsheets, *Nutrient Composition of Pig Feed Ingredients (On an As Fed and Dry Matter Basis)*, Agdex 440/63, and *Nutrient Recommendations for Pigs on An As Fed and Dry Matter Basis*, Agdex 440/52. Diets should be formulated in such a manner that the feed ingredients used meet the nutrient requirement of the specific class of pig (starter, sow etc.) and fall within the range of inclusion rates given in Table 1.

Included in the Factsheet are: definitions of some nutritional terms used in the Factsheet and a table listing factors which affect the use of different feed ingredients and the suggested maximum inclusion rate at which the ingredients can be added to the diet of different classes of pigs.

A. Feed Terms Defined

1. **Anti-nutritional factor** is any factor in a feed ingredient which interferes with nutrient digestibility. Examples are trypsin inhibitors, tannins, and glucosinolates. Unless ingredients containing a trypsin inhibitor are heat processed (like raw whole soybeans), they will cause a decrease in protein digestibility and affect performance.

2. **Inclusion rate** is the rate at which a feed ingredient is added to a feed mixture. If 775 kg of corn and 225 kg of supplement are mixed to make 1 tonne of hog grower, the inclusion rate of corn is 775 kg, or 77.5% of the feed mixture.

3. **Nutrient Variability** indicates the variation in nutrient content in different samples of the same feed ingredient. Many by-products, such as bakery waste, are extremely variable in their nutrient content. This variability makes these feed ingredients more difficult to use.

4. **Palatability** is the term used to describe the extent to which a pig likes to eat a given feed ingredient or diet. Soybean meal is very palatable while wormseed mustard is not palatable at all.

5. **Stability** is the extent to which a nutrient or feed ingredient will remain intact in its original form. Stability is necessary for nutrient availability and usefulness. For example, vegetable oils which are not "stabilized" with an antioxidant will go rancid quickly. Rancid oils (or other fats) are very unpalatable, hard to utilize and increase the pig's requirement for vitamin E.

B. Usefulness of Feed Ingredients

Many factors affect the usefulness of feed ingredients. One must consider: cost; supply; storage life; ease of handling (does the ingredient require special equipment in order to feed it?); nutrient variability and availability (digestibility); palatability; presence of anti-nutritional factors and age of pig the feed ingredient is intended for.

Table 1 lists feed ingredients and factors which affect the extent to which the ingredient can be used for pig feed. Also shown are suggested maximum inclusion rates for each class of pig (starter, grower, lactating sow, etc.), which are based on the limiting factors. These suggested maximum rates are intended to be viewed as ceiling rates; if the ingredient is fed at rates above the maximum, animal performance can be decreased. **The feed ingredient can be fed at lower rates than the suggested maximum rate.**

Table 1 should be used in combination with Factsheets *Nutrient Recommendations for Pigs On An "As Fed" and "Dry Matter" Basis*, Agdex 440/52, and *Nutrient Composition of Pig Feed Ingredients (on An As Fed and Dry Matter Basis)*, Agdex 440/63. Diets should be formulated in such a manner that the feed ingredients used meet the nutrient requirement of the specific class of pig and their inclusion rates

* *The Technical Advisory Committee for Swine Nutrition is composed of OMAF, University and Feed Industry Nutritionists.*

are within the margins given in this table. Avoid using several low inclusion rate feed ingredients in the same diet; such a diet can be very unpalatable and result in poor pig performance.

The table groups growing and finishing pigs together, and dry and lactating sows together. Some feed ingredients (usually those with a high fibre content) can be fed at different rates within the same grouping. The table lists the suggested maximum inclusion rate for the class of pig within the grouping that would be the most adversely affected if the ingredient was fed at a higher rate. For example, look at the *Dry and Nursing Sows* section for Mixed Grain (Ont.) The inclusion rate for mixed grain is listed at 25% of the diet. Mixed grain is low in energy, and a high producing lactating sow may be short of energy if fed a diet containing higher rates of mixed grain; however, a dry sow can be fed a diet which uses mixed grain as the only grain source.

It is therefore important to understand the factors that affect the suggested maximum inclusion rates and calculate nutrient levels on a complete feed basis.

TABLE 1.
FACTORS AFFECTING USE OF FEED INGREDIENTS AND SUGGESTED MAXIMUM INCLUSION RATES RECOMMENDED

Feed Ingredients	Factors Affecting Use of Feed Ingredients	Suggested Maximum** Inclusion Rate (% of Total Diet)			
		Early Starter (5-10 kg)	Starter (10-20 kg)	Grower-Finisher (20-100 kg)	Dry and Nursing Sows
Alfalfa Meal, (20% CP)	High fibre content, low digestibility.	NR	NR	5	10
Bakery Waste, (Dried)	Variable in nutrient content; ingredients change from load to load.	?	NR	10	10
Barley (Ont. or Western)	Higher fibre and lower digestibility than corn; worth 90-95% the value of corn; may have to add fat to nursing sow diets to increase energy.	NR	30	83	83
Beans, White (cull)	Anti-nutritional factors - must be heat processed for pigs; can replace 50% of protein in pig diets.	NR	15	12	12
Beet Pulp (dried)	High fibre content, low digestibility; acts a laxative.	NR	NR	10	10
Brewers Grains (dried)	High fibre content, low lysine; however, is a good source of B-vitamins.	NR	NR	10	10
Canola, Meal	Higher fibre than soybean meal, lower palatability; can replace half the soybean meal in sow diets; anti-nutritional factors may interfere with reproduction at high inclusion rates in sow diets.	NR	5	10	7.5
Corn, (Ont.) (15% moisture)	Low lysine; high digestibility; Dry sows and finishing pigs can be fed higher levels. Check for mycotoxins.	55	71	77	77
Corn, High Moisture (28% moisture)	High moisture content; low lysine; diet should be balanced on a dry matter basis.	NR	NR	78	78
Corn + Cob Meal	High fibre content, lower energy and low digestibility; could be used only in gestation diets up to 70% of the diet.	NR	NR	NR	NR
Corn Gluten Feed	Low lysine, high fibre content, variability.	NR	NR	5	5

NR = *not recommended*
? = *not enough information for a recommendation to be made*
** = *Rates up to and including the maximum can be used.*

TABLE 1.
FACTORS AFFECTING USE OF FEED INGREDIENTS AND SUGGESTED MAXIMUM INCLUSION RATES RECOMMENDED
(continued)

Feed Ingredients	Factors Affecting Use of Feed Ingredients	Suggested Maximum** Inclusion Rate (% of Total Diet)			
		Early Starter (5-10 kg)	Starter (10-20 kg)	Grower-Finisher (20-100 kg)	Dry and Nursing Sows
Corn Gluten Meal	Low lysine, low fibre, variability.	NR	NR	5	5
Fat (Tallow)	Quality depends on manufacture; variable fatty acid composition; 1-2% useful for dust control. Check for rancidity. Nursing sows can be fed higher levels.	10	10	3	3
Fat (Soy oil)	High in polyunsaturated fats, which increases vitamin E requirement; can cause soft fat in carcass when fed at high levels. Check for rancidity. Nursing sows can be fed higher levels.	10	10	2	3
Fish Meal	Variable nutrient content depending on the source of the meal; can cause fishy flavour in meat; high digestibility. Poor quality meal can cause reduction in intake. Salt levels can vary.	10	5	5	5
Lupins (Sweet, White)	High fibre content; some anti-nutritional factors.	NR	5	10	NR
Meat Meal (Ont.)	Protein level and digestibility variable, low tryptophan, methionine; good source of phosphorus. Can contain a considerable amount of ash (bone).	NR	NR	5	5
Milk, Skim (dried)	Expensive; quality may vary due to manufacturing procedure; it tends to absorb moisture; very palatable; high lysine content, high digestibility.	20	20	10	10
Milk, Whole (dried)	Expensive; very palatable, high digestibility.	20	20	10	10
Mixed Grain (Ont.)	High fibre; low energy; may reduce growth rate; poorer feed conversion; can be used as only grain source for dry sows.	NR	NR	25	25
Oats (Ont.)	Same as for mixed grain except should not be used as only grain source for any sows.	NR	NR	20	20
Oats (Western)	Little higher in protein and energy than Ont. oats; still high fibre; higher selenium.	NR	NR	20	20
Oats, Tibor (Hulless)	Can have up to 18% protein; higher oil content and lower fibre than regular oats. Low in lysine content; can replace 100% of corn.	20	20	95	95
Peas, field	Low levels of anti-nutritional factors; have good amino acid profile; protein content varies with variety; low in methionine.	?	?	30	?
Soybean Meal (44%)	Has hulls, so higher fibre content than 48% meal; may vary in protein content depending on source. Over or under heating reduces quality.	20	30	25	25
Soybean Meal (48%)	No hulls, so higher digestible energy than 44% meal; varies less in protein content than 44% meal. Over or under heating reduces quality.	20	30	25	25

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Feed Ingredients	Factors Affecting Use of Feed Ingredients	Suggested Maximum** Inclusion Rate (% of Total Diet)			
		Early Starter (5-10 kg)	Starter (10-20 kg)	Grower-Finisher (20-100 kg)	Dry and Nursing Sows
Soybeans, whole (roasted/extruded)	High in polyunsaturated fats so Vitamin E requirement is increased; can cause undesirable aftertaste in pork if fed above 10% of the diet.	?	?	10	25
Triticale (Ont.)	Poor palatability at high inclusion levels. New cultivars are producing better results.	?	?	35	35
Wheat, Bran	High fibre content; low energy and low digestibility; is a laxative.	NR	NR	5	15
Wheat, (hard red spring)	Higher in crude protein than corn; but not proportionately higher in lysine; lower in digestible energy than corn but higher than barley; diets dusty and unpalatable if finely ground; high gluten content.	40	57	57	57
Wheat, Ont. (soft white winter)	Similar to corn in crude protein, but higher in digestible energy; also dusty and unpalatable if finely ground; high gluten content.	40	57	57	57
Wheat, Middlings	Similar to corn in energy content; higher than corn in crude protein and lysine content; expensive.	0	60	60	60
Wheat, Shorts	Fibre higher than barley; digestible energy similar to barley.	0	10	25	25
Whey, Dried	Lactose (milk sugar) content; tends to absorb moisture; quality can vary depending on manufacturing process; expensive.	20	20	10	10

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